"Autonomic nervous system"

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مقدمة* / تذكير

Nervous System

① Central nervous system

Brain — spinal Cord

1. Cerebrum
2. Cerebellum
3. Brainstem

② Peripheral nervous system

1) Cranial nerves 12 pairs
2) spinal nerves 31 pairs
3) Autonomic nerves
   a) sympathetic nerves
   b) parasympathetic //

* Brain stem Consist of:-
1) med brain. 2) Pons
3) medulla oblongata

* Autonomic nervous System:-
is the part of the peripheral nervous system that regulates the activity of ① viscera, ② glands, ③ heart and ④ blood vessels

- involuntary nervous system
  ↓
  Autonomic nervous system

- Voluntary nervous System
  ↓
  Somatic nervous system
  or Central // //
  ← Skeletal ms

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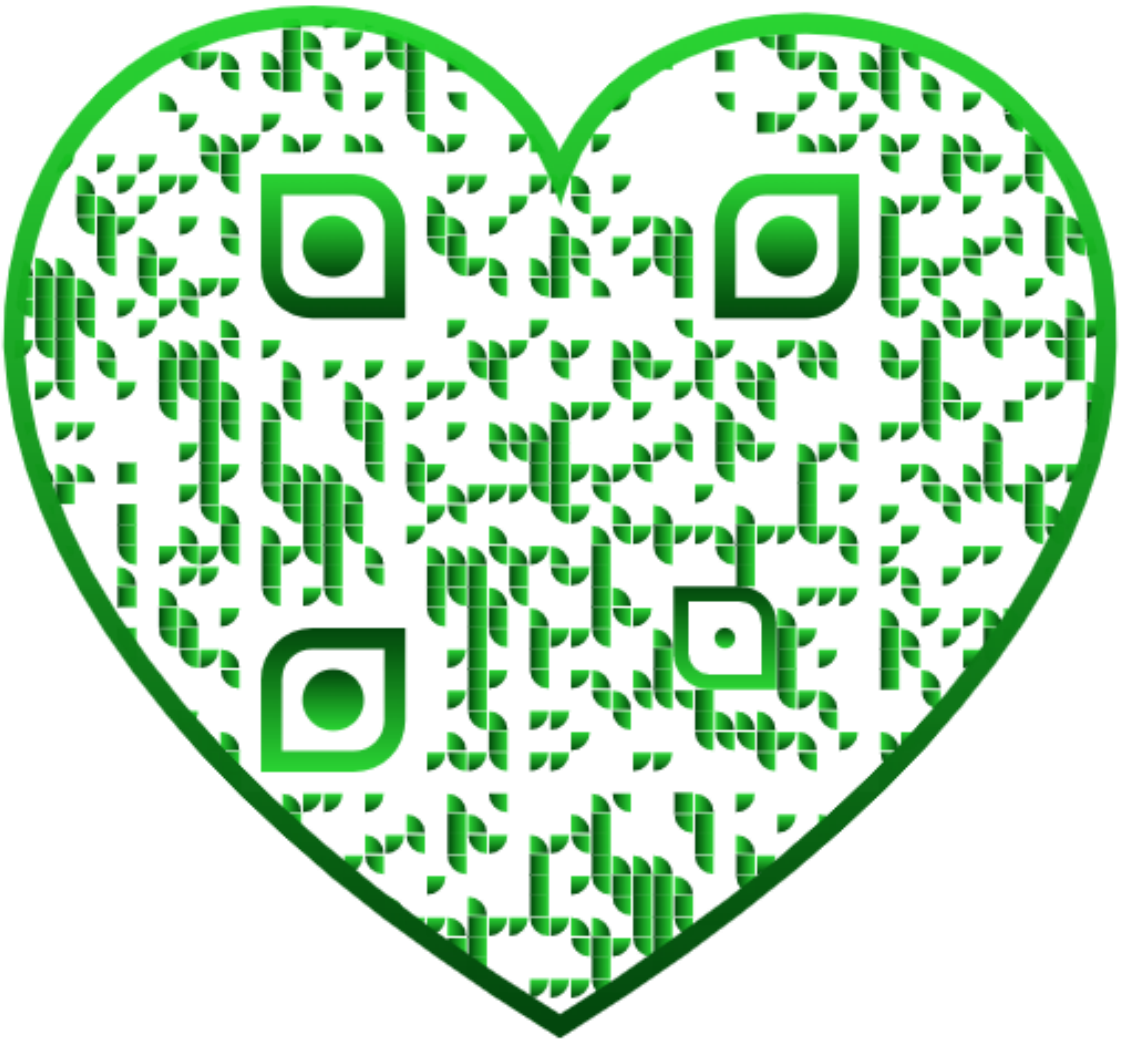

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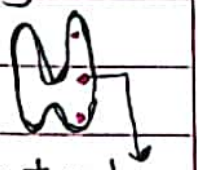
-segments is: - منشأ خروج الأعصاب

عددها 31

- 8 Cervical
- 12 Thorax
- 5 lumbar
- 5 sacral
- 1 Coccygeal

Segment



Lateral horn Cells

The origin of

The sympathetic nervous system	The parasympathetic nervous system
from → lateral horn Cells of all thoracic and upper 3 lumber segments of spinal Cord.	from → ① lateral horn Cells of 2nd, 3rd and 4th Sacral segements of spinal Cord. ② The nuclei of Cranial nerves: - 1973 1) Oculomotor n. (3rd) 2) facial n. (7th) 3) glossopharyngeal (9th) 4) Vagus (10th)

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• Cranial nerves :-

1- olfactory. nerve.
2- Optic nerve
3- Oculomotor nerve.
4- Trochlear nerve.
5- Trigeminal nerve.
6- Abducens nerve.
7- Facial nerve
8- Acoustic ⇒ vestibular nerve.
9- glossopharyngeal nerve
10- Vagus nerve.
11- Accessory nerve.
12- Hypoglossal. nerve.

• Reflex action :- Consist of :-

1) receptor. 2) sensory n. (Afferent)
3) Central 4) motor n. (Efferent)
5) effector organs

involuntary response to the stimuli.

types { • somatic reflex → regulate the activity of skeletal ms.
• Autonomic reflex → regulate the activity of the viscera.

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follow

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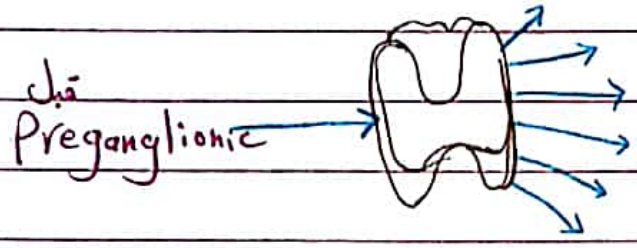
• Autonomic ganglia :-
is a collection of nerve cells outside the C.N.S



• Nuclei :-
is collection of nerve cells inside the C.N.S

Autonomic reflex	somatic reflex
-involuntary	-voluntary.
-يغذي → (vesera-gland-B.v. - heart)	-يزني → skeletal musles
-arises from lateral H.C	-arises from ant. H.C.
- Contain ganglia	-doesn't.

* Function of ganglia :-
-distribution التوزيع → each preganglionic fiber diverges to average 8-9 postganglionic neurons.
* each nerve has one specific ganglia except facial nerve which have 2 ganglia.

* Types of autonomic ganglia :-
1) lateral. 2- Collateral 3- Terminal
for sympathetic for parasympathetic

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* division of sympathetic nervous system

1) Cervical ⇓ يغذي -head -neck

2) Cardio-Pulmonary ⇓ يغذي -heart-lungs

3) splanchnic ⇓ يغذي -Veseral الحوض والبطن

4) ↓ somatic division ⇓ يغذي -skin- skeletal ms.

1 Cervical division

origin & lat. horn cells of the upper 2 thoracic

[a] Function of sympathetic for the "Eye" :-

1) mydriasis (توسع حدقة العين) → Contraction of dilator pupillae ms. (شد جفن العين)

2) lid retraction → Contraction of sup. + inf. tarsal ms. (جحوظ العين)

3) exophthalmos → // // Muller's ms. (Hyperthyroidism)

4) Vasoconstriction → تضيق الأوعية الدموية للعين

5) relaxation of the Ciliary ms. during far vision.

not/ Vasoconstriction كل مناطق الجسم عندما يشتغل sympathetic يحدث لها Vasodilitation ما عدا منطقتين يحدث لها

1) Blood ~~vessels~~ supply of heart

2) // vessels of skeletal ms.

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B Function of sympathetic for the "salivary gland"

exocrain

1) Trophic (غير حقيقي) secretion → sympathetic يفرزها.
   * small in volume مميزاتها
   * Viscous. لزوجة
   * rich in enzyme and mucin

2) Squeeze Saliva → Parasympathetic يفرزها

3) VasoConstraction.

Component of salivary gland:-
1) sublingual.
2) submaxillary
3) parotid

C Function of sympathetic for the "skin":-

1) vasoConstraction.
2) sweat secration
3) Hair erection → انتصاب → due the Contraction of Pibmotor musdes.

notes

Salivary gland

- الرؤية للقريب Parasympathatic - الرؤية للبعيد Sympathatic
- المعقد العصبي الذي يشتغل فية P.S في نفس الوقت
- ال Para مسؤول عن كل الافرازات ماعدا:
  -sweat gland + Adrenal medulla.
- ال Para يزود عملية الافراز للعاب وال S يضخ اللعاب.
- نواقل: Para ← استايل كولين. S ← ادرينالين - نورادرينالين -

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- Horner's syndrome :-

is an injury to the Cervical sympathetic nerve fibers produce a syndrome on the same side.

*symptoms of horner's syndrome :-

1) Ptosis → drop of upper eye lid [يشلل العضلة الرافعة]
2) miosis → Pupillo constriction [يشلل العضلة الموسعة]
3) Anhydrosis → Absent of sweating
4) Vasodilation → احمرار وارتفاع درجة الحرارة
5) enophthalmos → غئور كرة العين للخلف [يشلل عضلة Muller's]

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2 Cardio-Pulmonary divisions:-

• The origin → from lateral horn cell of upper 4T
{T_1, T_2, T_3, T_4}

1 Function of the sympathetic of the "heart":-

a- stimulates all properties of the Cardiac muscle.
* Contractility.
* heart rate.
* exitbility
* Conductivity.

b- V.D

c- increase O_2 Consumption.

2 Function of the symathetic of the "lung"

a) bronchodilation.

b) V.C → تضيق

c) decrease mucus secretion

The allergy: * سبب مرض الربو
* أعراضه:
1) bronchoconstraction
2) increase mucus secretion

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3 Splanchnic division → greater / lesser

- origin →
  - greater splanchnic div. :-
    - from lateral horn cells of [T_7 to T_{12}]
      [For Abdomen]
  - lesser splanchnic div. :-
    - from lateral horn cells of upper 3 L [1L, 2L, 3L]
      [For Pelvis]

---

1 Function of sympathetic for "Abdomen"

a) vasoConstraction.

b) relaxation the wall of (stomach, small instine, proximal part of large insestine) and Contraction their sphincters ← عاكس

c) Contraction of spleen.

d) stimulation glycogenolysis → تكوين الجلوكوز Glucose

e) stimulation of adrenal medulla.

f) inhibits insulin hormone secretion.

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* organs of the Abdomen:-

1) stomach.
2) small intestine → duodenum – jejunum, ileum
3) proximal part of large intestine →
4) Kidney
5) liver
6) pancreas.

- Ascending Colon.
- Transverse "
- descending "
- Sigmoid "

[2] Function of sympathetic for the "pelvis"

a) relaxation of the wall of Urinary bladder and Contraction the internal sphincter.

b) relaxtion the wall of the rectum and distal part of large intestin and Contraction the internals.

c) V.C and inhibition of erection.

d) ejaculation of semen in Male (Contraction of the smoth ms. in the vas deferens.

e) in Female produce variable effects on the uterus (contraction, relaxation)
estrogen — progestron

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4 Somatic division

*origin →

1 Function of sympathetic for the "skin"

a) V.C
b) sweet secretion.
c) hair erection.

2 Functions of sympathetic for "skeletal ms"

1) orbelli effect :- It's effect of sympathetic of skeletal ms. during excersise.
- مميزاته :
1) V.D during excersise.
2) stronger contraction.
3) delayed fatigue. تأخير الإجهاد
~~4) V.C during bleeding or hemorrage~~

2) V.C during bleeding or hemorrage

notes:- * لما نقص O_2 في الخلايا يحدث شد عضلي بسبب تراكم lactic acid
لا يحدث في عضلة القلب ؟
لأنها تستخدم lactic acid كوقود للقلب .

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Parasympathetic Nervous System @AL-KOHLANI

(Cranial Parasympathetic)

1 The Oculomotor (3rd Cranial) nerve :-

- origin → arise from edinger-westphal nucleus of midbrain of brainstem.

* Functions of oculomotor nerve for the "eye"

1) myosis → Contraction of Constrictor pupillae ms.
2) Constraction of Ciliary muscle →
   * accommodation of eye for near vision.

* Effect of occulomotor nerve :-

1) mydriasis → pupil dilatation
2) loss of accommodation of eye for near vision.
3) lateral squint → medial rectus ms. حول جانبي

2 The facial (7th Cranial) nerve :-

- origin → arise from superior nuclei from pons of Brain stem
- relay → to →
  - submaxilary ganglia → supply → ① submaxillary ② sublingual ③ anterior 2/3 of tongue
  - sphenopalatine ganglia → supply → ① nasopharynx ② lacrimal gland

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* Functions of facial nerve for (salivary gland):-

1) V.D
2) True secretion
   - watery saliva
   - large in volume
   - little enzymes.

3 The glossopharyngeal (9th Cranial) nerve:

- origin → from medulla oblongata from (inf. salivary nuclei)

- Function of glossopharyngeal nerve for (salivary gland)

1) V.D
2) True secretion
   - watery saliva
   - large in volume
   - little enzyme.

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4] The Vagus (10th Cranial) nerve:

- origin → arise from vagus nucleus in medulla oblongata.

- Functions of vagus nerve for the (Heart):
  1) inhibition of all properties of the heart.
  2) V.C
  3) decrease O_2 Consumption.

- Functions of vagus nerve for the (lungs):
  1) Broncho Constriction.
  2) increase mucus secretion
  3) V.D

- Functions of vagus for the (Abdomen):
  1) Contraction the wall of esophagus, stomach, small intestine and Proximal part of the large intestine and relaxation their sphincters.
  2) Contraction of gallbladder in the wall and relaxation of it's sphincter.
  3) in glands increase secreation of :-
     - stomach → gastric juice secretion.
     - Pancreas → pancreatic 〃 〃
     - Liver → bile Secretion.
     - Duodenum → mucus 〃.
  4) V.D of the hepatic blood vessels.

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((Sacral Parasympathitic))

* Pelvic nerve:-

- origin → from Lateral horn Cells of 2ned, 3rd 4th sacral segments.

- Function of the pelvic nerve:-

1) Contraction the wall of urinary bladder المثانة and relaxation its internal sphicter (in micturition)

2) Contraction the wall of rectum and distal part of large intestine and relaxtion their internal sphicter المعصرة ← (in defecation)

3) increase secretion of the seminal vesicles → Semen and prostate → تفرز الكلايتن

4) V.D and stimulation of erection of penis in male and clitaris in female

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C.V.S

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- Cardiovascular System :-
→ it's the blood Circulates in Closed system.
→ Consist of → Heart - blood vessels

- Blood pressure in Heart :-

- R.A = 0-2	- L.A = 8
- R.V = 25	- L.V = 120 (وقد يصل إلى أعلى ضغط 140)
↓ 40% نسبة أكسجين R	%100 ↓ نسبة أكسجين L

* The Atrial is ((thin)) and The ventricles is ((thick))

* The L.V is thicker (من 3-4 مرات) than The R.V ??
لأنها تتحمل ضغط عالي = 120، وتضخ الدم للجسم كامل

* The Cardiac output is 5.5 L/min.

- Atrial act as → Blood reservoirs.
- ventricles act as → pumping chambers.

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• Types of valves :-

- atrioventricular valves
  - ① tricuspid valve (R) ⇓ between R.A and R.V
  - ② mitral valve (L) ⇓ between L.A and L.V
- semilunar valves
  - ③ aortic valve (L) ⇓ between L.V and aorta
  - ④ pulmonary valve (R) ⇓ between R.V and pulmonary.

• Function of the valve :-

→ allow blood to pass in one direction.

• سبب الفشل في القلب ← ارتخاء في mitral valve
← عند ضخ الدم من L.V ينتقل نصفه إلى aorta والباقي يرجع إلى L.A فتكون كمية الدم التي خرجت أقل من 5.5
• علاجه ← تغيير صمام صناعي.

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"Division of Circulation"

① The Systemic
greater Circulation

* starts from Left ventricle
- aorta
- Large arteries
- small arteries
- arterioles
- Capillaries
- Venules
- Veins
- sup. and inf. Venae Cavae
- right atrium.

② The Pulmonary
Lesser Circulation

* starts from right v.
- pulmonary artery
- lungs
- pulmonary Capillaries
- 4 pulmonary veins
- Left atrium

notes :-

* pulmonary a. يحمل دم غير مؤكسج كامل ما عدا أنه يحمل O_2 بنسبة 40٪
* 4 pulmonary v. يحمل دم مؤكسج كامل ما عدا أنه يحمل O_2 بنسبة 100٪

③ Special Circulation
ex → Cerebral Circulation

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* Functions of artery:
→ Transport of blood from heart to tissue.

* Functions of arterioles:
→ 1) Transport of blood from heart to tissue.
2) Regulation of blood flow.
3) // // // pressuer through V.D & V.C:-
a) V.D → ↓ pricipheral resistance → ↓ B.P
b) V.C → ↑ // // → ↑ B.P

* Functions of veins:
→ 1) Transport of blood from tissue to the heart.
2) storage of blood.

* Functions of Capillaries:-
1) veins and Artery
2) exchange.

* Characteristic of blood vessels:-
1) The aorta, pulmonary a. and large a. are elastic.
2) The med-size and small a. are muscular ↓ resistance V.
3) The arterioles are muscular ↑ resistance vessels.
4) The Capillaries are exchange vessels
5) The veins and pulmonary vessels are volume resistance.

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Functions of The Heart ♥

(Function of ventricles)

1) Pumping of blood
   - L. V. → aorta
   - R. V. → Pulmonary

(Function of atria)

1) entry-ways to the ventricles ← يستقبل الدم ويضخه للي
2) Contain stretch receptors found in atrial wall.
   - تعمل على تنبيه Cardiac Center ← عند زيادة الضغط داخل الـ atrium
3) secrete the atrial natriuretic peptide (ANP)
   - increase excretion of sodium in Urin.
4) Booster Pumping action in sever exersis.
   - تدعيم في الحالات الاستثنائية.

- Function of (ANP) :-

الهرمون الوحيد الذي يفرز من القلب من R.A

[Atrial Natriuretic peptide]

- Increase excretion of Na in the Urine and H_2O ← blood volume ↓
- it's secrete during hypertension ← ↑ blood volume
- Aldosterone ← يوقف عمل

E.F → قوة انقباض عضلة القلب

أكثر 65 → يساوي

إذا نقصت لازم تدعيم عضلة القلب نعطي المريض Digoxin

علاج مقوي لعضلة القلب

لكنه سام وخطر جداً يستخدم 3 أيام ويومين لا.

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note:- -parasympathetic has no related with Contractility
Because vagus nerve supply atrium and don't supply ventricl.

* The Cardiac muscle fibers

Types

99%	1%
(1) Contractile Cardiac muscle fiber	(2) Conduction Cardiac muscle fiber
-The main Function is pumping (Contraction & relaxation)	-if it stoped it's Function → it lead to stop Conduction fiber → then it Cause death.
-it Contain the Contractile protein: 1) actin. 2) myosin. 3) troponine 4) tropomyosin.	-There are 3pace maker in the heart. 1) Primary → sinoatrial node. 2) secondary → atrioventricular node. 3) tertiory → purkinje node.

note :- في الجسم من يستطيع الانقباض وهو ليس عضلة :
→ platelets.
→

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. Mechansim of transport the impulse

* start in → primary pace maker [sinoatrial node]
↓ send impulse to
atrioventricular node
↓ to
atrioventricular bundle
↓ it well divided to
Left and Right branch
↓ and at the end
purkinje fibers. ← سريعة جداً في التوصيل

The fuel of the heart :-

	* during rest *	* during exercise *
يستخدم القلب	- fatty acid · 60-70%	- lactate
	- glucose	- fatty acide
	- lactate	- glucose

- sympathetic stimulation all properteis of the heart.
- Parasympathetic inhibition " " " " "
Except → Contractility.

* بعض الأحيان يحصل لهم تشوه خلقي! بوجود bundle إضافية تؤدي إلى tachycardia
هذا المرض يسمى ← Wolff porKins White Syndrome
A / V ← bundle of Kent بين ← بسبب وجود

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• The arterial blood presswre •

→ is the lateral pressure exerted by the blood on the blood on the arterial walls.

• Contraction of Cardiac muscle is → Systole انقباضي
• Relaxation of Cardiac muscle is → diastole انبساطي

→ pressure : systole / diastole = (90↑140) / (60↓90)

(100 - 110 - 120 - 130) normal

(70 - 80) → normal

• نركز عند قياس الضغط على Diastolic لأنه ثابت لا يتغير لكل حالة مرضية بينما Systolic ← يتغير لأي حالة .

• The systolic B.P prduced by→
ejection (Pumping) of the blood into the aorta

• The Diastolic B.P produced by→
elastic recoil of the aorta.

• N.B :- لا توصف علاج لمرضى السكر والضغط مباشرة .
أولاً نطلب منهم عمل رياضة وحمية وإذا استمر الضغط والسكر مرتفع نخبرهم لهم علاج لأنهم سوف يظلوا يستخدموا هذا العلاج طوال حياتهم .

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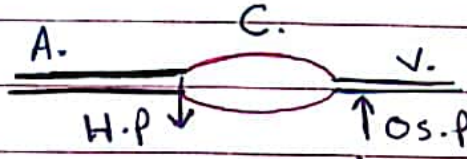
• Function of arterial Blood pressure •

1) It maintains blood flow to the different tissue.

2) It produced the Capillary hydrostatic pressure



Hydrostatic pressure	Osmotic pressure
30	- 25
تعتمد على - Blood pressure	- plasma protein
وظيفتها - filteration	- Reabsorption
يزداد نتيجة - hypertension	- hypotension

↳ 60 = Kidney * كلها في الجسم ما عدا في الـ
A C A عشان كلها تعمل فلترة بكبوه

- transport from Cappillary to tissu fluid
- transport from tissus to Cappillary

• The Function of diastolic B.P :-

1) maintain blood flow to the different tissue during diastole.
2) It's essential for normal Coronary blood flow.
3) It prevents blood stasis in the arteries during diastole.

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Explain

- physiological Factors that effect the arterial blood pressure:-

① Body region:-

in arm or thigh نقيس الضغط في.

→ but in thigh is more than arm in about (5-10 mmHg)

② Age:- . in old age The elastisty in low so The blood pressur is high.

and . in infant the opposite

③ Sex :- A) befor puberty :-

- normal B.p in Male = Female.

after B) ~~befor~~ puberty:-

- in male more than Female, because Estrogen hormone more in female

DL ? Cholesterol كلما زاد الاستروجين كلما نقص

C) After menopouse :- (50-55 y)

. in Female more than male becouse decrease Estrogen hormone.

④ Body & built :- حجم

in obese Blood pressure is high, becouse it increase cholestrol in blood

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يومية, اختلافات

(5) Diurnal variation :-

- in morning low blood pressure, because :-
  1) Continous action of parasympathetic
  2) decrease activity of the life.

تغذية

(6) Meals :- (↑B.P)

- When digestion → ↑ blood supply → V.D in blood vessels which supply stomach → V.R → (Venous return) ↑ Cardiac output → lead to increase B.P

(7) Exercis
(8) Emotion
(9) sexual intercourse

→ increase sympathetic → ↑ adrenaline → ↑V.C → ↑P.R → which lead to ↑ B.P

(10) sleep :- ↓ B.P

- Parasympathetic is works → ↑ acetyl choline → ↑ V.D → ↓ P.R → lead to ↓ B.P

(11) Temperature :- ↑ B.P

- becaus increase heart rate [C.O = S.V x H.R) → ↑ Cardic output → ↑ Blood pressure

Ecept :- → ↑B.P في حالة الكوليس Sym يشتغل ويكون

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Factors that determine and maintain (A.B.P) :-

① Cardiac Output :→ C.O

↳ It's the amount of blood pumped by each ventricle/min.

$$B.P = C.O \times P.R$$

- stroke volume :- S.V
  ↳ it's the amount of blood - يعني pumped by each ventricle per beat.

during rest

R.A	L.A
R.V	L.V
5.5 mL/min	5.5 mL/min

- but it's increase during exercise → 35 L/min (أكثر بكثير ممكن توصلها)

Cardiac output = S.V × H.R
(S.V: stroke volume, H.R: Heart rate)

- So C.O ↑ → B.P ↑ علاقة طردية

Cardia output = venous return
C.O = V.R

② Peripheral resistance :- P.R مقاومة طرفية

- It's determind by 3 Factors :-

1) The diameter of vessels (V.D or V.C)
   - V.C → ↑ P.R → ↑ B.P
   - V.D → ↓ P.R → ↓ B.P
2) Blood viscosity → RB.C and plasma protein
3) The length of the vessels.

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③ Elasticity of aorta and large arteries :- عكسية علاقة

↑ Elasticity → ↓ B.P (Inversely proportional)

• تزيد المرونة في حديثي الولادة فيكون ضغطهم دائماً منخفض
↳ S = 70-80 / D = 40-50

والعكس عند old age ↓

• (Arteriosclerosis) → تصلب الشرايين
↓ فقدان مرونة Elasticity ← يزيد Systolic

40 ← Diastolic and systolic الفرق بين
↳ It's pules pressure
120/80

* if pules pressure 70 → hyperdainamic circulation.

④ Blood volume and Circulatory Capacity :-

↑ Blood volume → ↑ B.P

MCP ← venous return • سبب الزيادة في
main Circulatory pressure-

notes:-

• 5.5L في واحد نايم Cardiac output يظل ثابت

قانون starleng law ← كلما زاد طول العضلة يزيد انقباضها لحد معين

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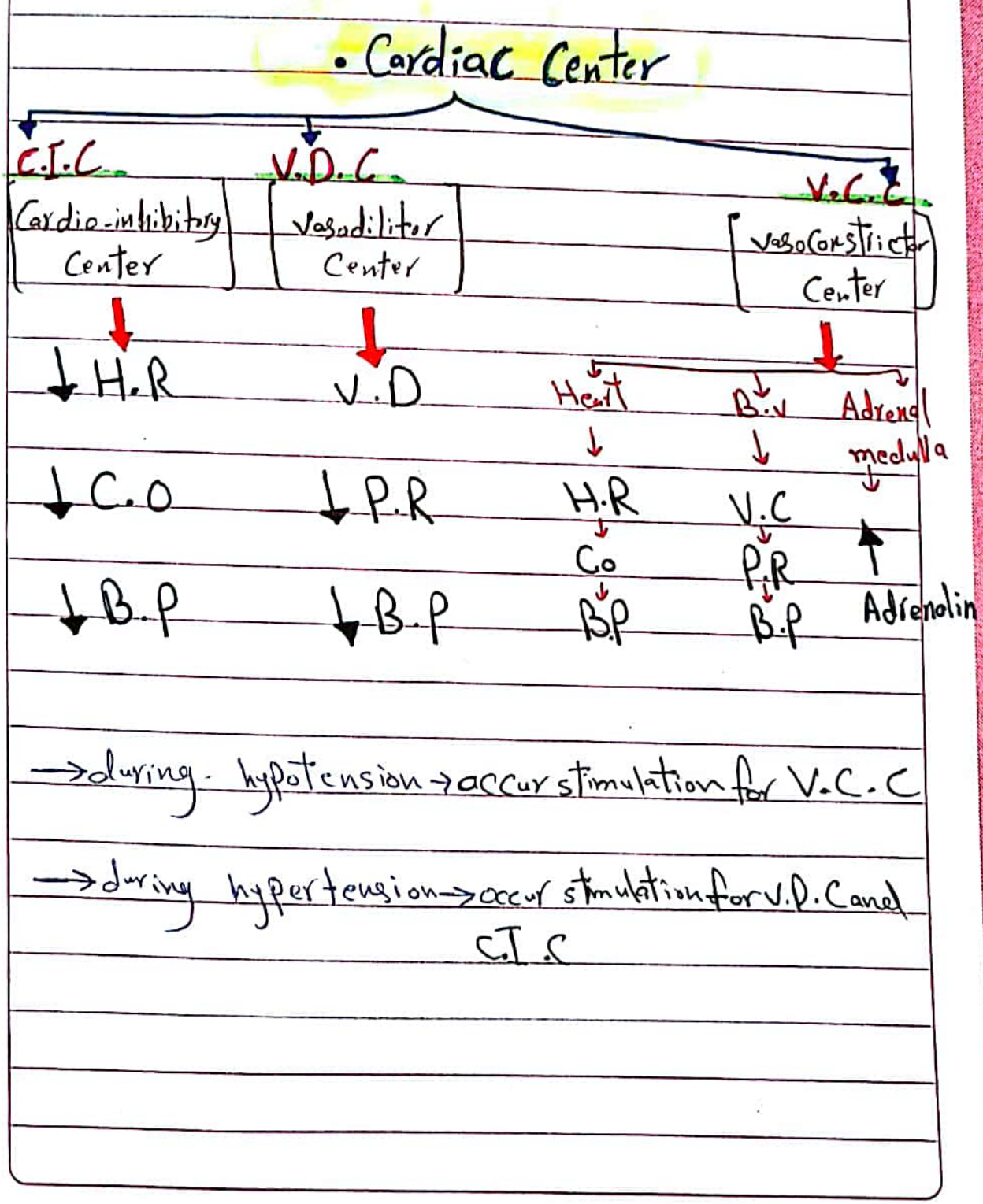
• Regulation of the A.B.P :-

- Cardiac Center :-
  - ↳ It's Collection of nerve cells in medulla oblengata.



→ during hypotension → occur stimulation for V.C.C

→ during hypertension → occur stimulation for V.D. Cand C.I.C

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* Regulation of the arterial blood pressure by:-

1) short - term mechanisms.
2) Intermediate - term mechanisms.
3) long - term mechanisms

1) Short - term mechanisms:-

a- it's potent (قوية) mechanism.
b- it's rapid (وتشتغل عن طريق الأعصاب)

- short - term mechanism include:-

① Arterial baroreflexes:-

→ it's type of short term Mechanism.
→ it acts by arterial baroreceptors.
→ found in Carotid sinus & aortic arch

* Types of baroreceptors:-
1- arterial
2- atrial
3- Ventricular
4- pulmonary.

(تعمل بشكل رئيسي تنظيم ضغط الدم)

* Mechanism of arterial Baroreflexes:-

- if the A.B.P increase
- The arterial baroreceptors stimulat
- send signal to Cardiac Center by buffer nerve
- stimulat of CIC & V.DC and inhibition VCC
- decreas P.R & adrenaline secreation
- Then it Cause decrase B.P.

- Buffer nerves:-
1) br. vagus n.
2) br. glossopharangeal n.

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② Arterial chemoreflexes :-

→ it's type of short-term regulation.
→ it act by peripheral chemoreceptor.
→ it found in Carotid & aortic bodies

* Mechanism of Arterial chemoreflexes :-

→ if arterial blood pressure decrease ↓
• stimulation of arterial chemoreceptors (by buffer nerve) ↓
• send signal to Cardiac center ↓
• stimulation V.C.C and inhibition VDC & CIC ↓
• increase C.O & increase P.R & adrenaline ↓
• Then The Blood pressure return to normal state.

* chemoreflexes :-

1) Central :-
→ in medulla oblengata.
→ H^+ تعمل مراقبة لـ
الي حول brain
→ CO_2 متأثر بـ

2) préphral :-
→ in Carotid and aortic bodies.
→ CO_2, O_2, H_2 متأثر بـ

③ The CNS ischaemic response :-

→ it's type of short-term regulation
→ it stimulated during hypotension

• ischaemic → نقص blood supply

• Mechanism of CNS ischaemic response :-

if blood pressure decrease → The blood supply decrease → it Cause Brain ischaemia → Cause hypoxia → stimulation of V.C.C → increase of C.O & P.R & Adrenaline secration → Then increase blood pressure

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4- The abdominal Compression reflex :-

→ it's type of short term regulation.

*** mechanism of abdominal Compression reflex :**

→ When the VCC is stimulated

⬇

Contraction of the abdomenal muscles

⬇

increase intra-abdominal pressure

⬇

Compression of the abdominal vein Causes to ↑ V.R

⬇

increase C.O (Cardiac output)

⬇

increase Blood pressure

- Why the stimulation of VCC increase Contraction of abdominal muscles ? لماذا

بسبب [Retecular formating] أعصاب موجودة في medulla oblengata and Pons

تجعل الانسان يقظ ولو انقطعت يدخل الانسان في نوم عميق

ARAS → Ascending Retecular Activating System

انسان ↑ → Ascending tract

نازل ↓ → Descending tract

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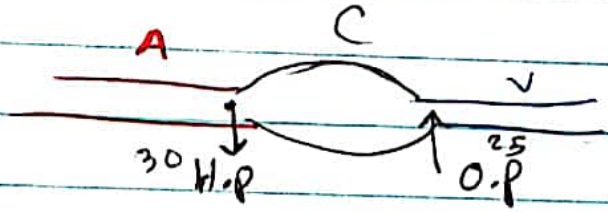
2. intermediate term mechanism :-

1) Capillary fluid shift mechanism :-

Increase blood volume
↓
↑ Capillary hydrostatic p.
↓
increase filtration into tissue
↓
decrease blood volume
↓
decrease B.P

decrease blood volume
↓
↓ hydrostatic p. and
↑ osmotic p.
↓
increase absorption
↓
increase blood volume
↓
↑ increase B.P



* ليش المصابين بأمراض الكبد يصابو بـ edema ؟
لأنو plasma protein المسبب لـ osmotic P. اسمه albumian
↳ يصنع في الكبد
يقل تصنيعه فيقل O.P ويزداد H.P وتزداد عليه الفلترة

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2- Renin - angiatensin mechanisms-

→ during hypertension → decrease Blood supply to Kidney (renal ischaemia) → stimulation secreation of Renin → Convert the angiotensinogen to angiotensin I → then by angiotensin Converting enzyme Convert angiotensinI to angiotensin II → V.C & relase aldosteron → ↑P.R & ↑Blood v. → This lead to ↑ B.P

Aldosteron → medullary Cortex يفرز من
↳ يعمل reabsorption Na^+ على

3- Right atrial mechanism

→ Increase Blood volume → increase V.R → Right atrial distension → stimulation stretch receptor in right atrium → send signal to Cardia Center → V.D → ↓P.R → ↓B.P

↓ADH → ↑urine excretion → ↓ Blood v. → ↓ B.P

→ Secreation ANP → ↑ exretion Na in Urine
↓Blood volume → ↓ B.P

• ماهي الحالة اللي ماينفعش نستخدم فيها أي علاج للضغط ؟
تضيق الشريان الاكليلي .

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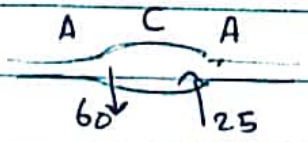
3 long-term mechanism :-



- in Kidney
  - Hydrostatic pressure 60
  - Osmotic pressure 25

because Capillary in Kidney Connected between 2 arterials → [H.P ↑ than O.P]

- in glomerular Capillary never occur reabsorption :nit Just filteration , because O.P verey low 25

* long term mechanism regulat Blood pressure by:-

in Kidney
1) glomerular filtration
2) secretion of aldosterone hormone

→ تفعيل

Notes

- There is 50-70 million in each Kidney.

- أول عرض للفشل الكلوي الحاد هو ← انقطاع البول بسبب glomerular filtration = صفر و هبوط

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* mechanism of (glomerular filtration).

→ during hypotension → ↓ Hydrostatic pressure
→ ↓ glomerular filteration → ↓ urine → ↑ B.P

→ during hypertension → ↑ Hydrostatic pressure
→ ↑ glomerular filteration → ↑ urine → ↓ B.P

* mechanism of (aldosteron hormon).

→ hypovolemia → ↓ B.P → stimulation Renin →
↑ aldosteron → { v.c / reabsorption Na^+ } → ↑ B.P

→ hypervolemia → ↑ B.P → inhibition Renin →

↓ aldosteron → ↑ urine → ↓ B.P

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* Heart Rate *

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• كيف نقيس عدد نبضات القلب Heart rate ؟

1) puls
2) stethoscope
3) ECG.

Vagus nerve → during rest

* Vagal tone :-
↳ It's Contenus inhipatory effect of the vagus in the heart during rest.

- ↑ Vagal tone → ↓ H.R
- ↓ Vagal tone → ↑ H.R

• normal range of H.R :-
60 - 100/min

- ↑ H.R ⟹ tachyCardia
- ↓ H.R ⟹ BradyCardia

* Physiological factor that effected in H.R ?

1) Age :→ in infant ↑ H.R (120-130), because absent of vagal tone.

2) Sex :→ in Female more than male, because weak vagul tone

التغيرات اليومية

3) Circadian rhythm (durinal varitions) → in the early morning the ↓ H.R because :- 1) Continous action of para
2) lost ↓ activity of life.

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4) Rest and sleep :— ↓ H.R because the parasympathetic is predominant.

الرياضيين

5) physical training :— ↓ H.R (45-50) because increase (strong) vagal tone

العصب التائه

6) posture : When yo sitting and sudden standing the H.R ↑ because : ↓ Blood pressure
(↓ v.R → ↓ C.O → ↓ B.P)

N.B :—

↓ H.R خطر → ↑ H.R

↳ كلما انخفضت قد يتوقف القلب

. الرياضيين عندهم H.R في حالة rest منخفض

. Marey's low → ↓ B.P → ↑ H.R

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* Regulation of Heart rate *

① Nervous
② Chemical

A. supra-spinal Center
B. reflexes from C.V.s
C. reflexes from extra vascular structurs.

① Nervous Regulation of H.R :-

A * supraspinal Centers *

1) The Cerebral Cortex
2) hypothalamus
3) limbic system

emotion العاطفة
↑ H.R دائماً تعمل
except shocking news
Cardiac arrest ↓HR جداً
↳ Death

4) Respiratory Center :-

(Respiratory sinus arrhythmia) التنفسية
↳ It's increase H.R during inspiration and decrease H.R during Expiration.

مثال
* Why the heart rate increase during inspiration?

1) Bainbridge reflex :- ⟶ جداً
↑ V.R ⟶ ↑ Right atrium pressure ⟶ ↑ H.R

2) Irradiation of impulses from the I Center
stimulation I. Center ⟶ ↑ V.C.C ⟶ ↑ H.R

3) pulmonary & baroreceptors. reflex
stretch receptor ⟶ V.C.C ⟶ ↑H.R
لترسل إشارة

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(B) Reflexes from C.N.S :-

1) Marey's law :- (arterial baroreceptor)

↑ B.P ⟶ ↓ H.R والعكس

↳ H.R و B.P قانون يحدد العلاقة العكسية بين

• Types of Bareceptor :-

1) Arterial
2) ventricular
3- pulmonary
4) Atrial

stimulation V.D.C C.I.C & inhibition VCC

1) Arterial & 2) ventricular	stimulation V.D.C C.I.C & inhibition VCC	3- pulmonary & 4) Atrial
1) V.D	1) V.D	1) V.D
2) hypotension	2) hypotension	2) hypotension
3) Brady Cardia	3) Brady Cardia	3) tachy Cardia.

* effects of stimulation of arterial bareceptor :-

1) stimulation CIC & V.D.C & inhibition VCC.
   1) V.D 2) hypotension 3) Brady cardia.
2) inhibition of secreation of the ADH ⟶ Polyuria
3) inhibition of respiratory center ⟶ apnea توقف وانقطاع النفس
4) inhibition of brain activity and muscle tone * ليس في during rest

muscle tone الـ في أي تقليل.

واقف بهذه الطريقة.

hypertonea - hypotonea ⟶ C.N.S ناخذها في

2 Bainbridge reflex :- (Caitrial stretch reflex)

↳ increase Right atrial pressure lead to increase Heart rate.

→ ↑ Right atrial pressure → stimulation to atrial receptor → stimulation Cardiac Center

* effect of increase right atrial pressure :-

1- generalized V.D and hypotension
2- Inhibition of ADH
3- stimulation of ANP
4- tachy Cardia (Bainbridge reflex) >100
5- tachypnea (Harrison's reflex) >20
6- Coronary V.D (anrep's reflex)

3 The ventricular stretch reflex (L.V) :-

↳ This reflex in L.V. Because it have Baroreceptors, while R.V Don't have baroreceptors.

- When L.V distension :t → hypotension & Brady Cardia (Cause)

- hypertension & aortic stenosis Cause distension of the L.V.

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4 Coronary Chemoreflex
(The bezold - jarisch reflex)

↳ Injection of Certain substances (serotonin) into Coronary vessles it lead to :-

1) apnea
2) hyperapnea
3) hypotension
4) Brady Cardia

V.C يعمل ← هرمون السعادة

* Clinicale important of Coronary chemoreflex :-

Notes :-

	• Baroreceptors	• chemoreceptors
الوظيفة الرئيسية	↓ Regulation of B.P in the body	↓ Regulation of Respiration
الوظيفة الثانوية	Regulation of Respiration	Regulation of B.P in the body

• pulmonary chemoreflex
Coronary chemoreflex ← يشبه
site ← الاختلاف فقط

MI (myocardial infarction) ← انقطاع تام الدم
Heart تغذية blood supply

MI if it strong → heart failure
" " " weak → nicrosis
في ملزمة ← 40

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C Reflexes from extravascular structures: (5)

1) from the lung :-

(a) pulmonary stretch reflex →
inspiration → Lung inflation → stimulation baroreceptor → stimulation V.C.C → tachy Cardia H.R↑

(b) Pulmonary chemoreflexes.
Injection of secration in pulmonary vessels Causes.

a) apnea
b) hyperapnea.
c) hypotension
d) Brady Cardia

2) from skeletal muscle (Alam smirk reflex)

during Contraction → tachy Cardia
→ tachypnea.

3) from skin & viscera:-

1) mild pain → tachy Cardia
2) severe pain → brady Cardia
→ Paralyل يشلل

يشتغل
Sym

4) from the eye (oculo-Cardiac reflex):

→ Pressure to the eyeball → send signle from Oculomotor nerve → stimulation of C.I.C —by vagus n.→ decrease heart rate (Brady Cardia)

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5) from the trigger area:

→ in M.O responsible for romiting.

trigger area :- in the Medlla oblengata

Vomiting لعلاقة بـ

1) larynx
2) epigastric
3) testis
4) eye

H.R ↓ Brady cardia

كلما زاد عدد الـ receptors كلما كان الألم شديد.

أعلى نسبة receptor موجودة في الجسم في :

1) lips
2) Anus

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Regulation of Heart rate

- Nervous R. → ✱Done
- Chemical R.
  - Gases
    - ↓ O_2
    - ↑ H & CO_2
  - hormones & drugs

*Effect of changes in blood gases:-

1) hypoxia (↓ O_2)

a) Mild to moderate hypoxia ⟶ ↑ H.R

Because:- 1) Direct stimulation of (SAN) sinoatrial node.
2) Inhibition of Cardioinhibitory Center (CIC)
3) Reflex mechanism → stimulation of preiphral chemoreceptor → ↑ C.C → ↑ H.R

b) severe hypoxia ⟶ ↓ H.R

by:- 1) Inhibition of (SAN) sinoatrial node
2) Paralysis of Grdio vascular Center in medulla oblongata.

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② hyper Capnia ($\uparrow CO_2$) and acidosis ($\uparrow H^+$) :-

a) Mild to moderate hyperCapnia & acidosis → ↑ H.R
because :- 1) Inhibition of Cardioinhibitory Center → ↑ H.R
($\uparrow CO_2$) 2) stimulation of Central & peripheral chemoreceptor → ↑ V.C.C → ↑ H.R
($\uparrow H^+$) 3) stimulation of Peripheral chemoreceptor → ↑ V.C.C → ↑ H.R

b) Severe hyper Capnia & acidosis → ↓ H.R
because :- 1) Inhibition of sino atrial node (SAN)
2) paralysis of Cardiovascular Center in medulla oblangata

* Effects of hormones & drugs :-

1) Adrenaline

a) small dose ↑ H.R
- direct stimulation of (SAN)

b) large dose ↓ H.R
- ↑ V.C → ↑ P.R → B.P → ↓ H.R (marey's law)

2) Noradrenaline (↓ H.R)

- ↑ V.C → ↑ P.R → ↑ B.P → ↓ H.R

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3- Thyroxin ↑H.R
by :- 1) direct stimulation of (SAN)
2) increase respones of heart to adrenaline
3) " metabolism.
↑metabolism → ↑V.D → ↑ V.R → ↑RAP → Right atrial pressure
→ ↑H.R (Bainbridge reflex)

4) Histamine ↑H.R
-↑V.D → ↓P.R → ↓B.P → ↑H.R (marey's law)

5) bile salte ↓ H.R
by :- 1) direct inhibition of (SAN)
2) stimulation of C.F.C
(obstructure juindice) ← Bile salts ترتفع.
It's Symptomes :- 1) severe jundice
2) brady cardia
3) itching حكة

6) Atropine ↑H.R (↓secretion)
by block parasympathetic.

7) Autonomic drug :-
.parasympathetic → ↓ H.R
.sympathetic → ↑ H.R (direct stimulation SAN)

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* Cardiac Output *

→ is the amount of the blood pumped by each ventricle per minute (5.5 L/min)

C.O = S.V x H.R

→ stroke volume (S.V) → is the amount of the blood pumped by each ventricle per beat (80mL)

⇒ Cardiac cycle → systole :- ejection of the blood
→ diastole :- full the ventricle

*** End systolic volume (ESV) :-**
the amount of blood in the ventricle at the end of systole (50mL)

*** End diastolic volume (EDV) :-**
the amount of the blood in the ventricle at the end of diastole (130 ml)

note :-
- Cause increase End systolic volum :
  1) aortic stenosis.
  2) dilated of heart.

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* Factors effected in End systolic Volume (ESV) (3)

1) Nervous → Sympathetic ↓ ESV
   → Parasympathetic

2) physical → temperature → ↓ ESV

3) chemical → drugs (degitalis) → ↓ ESV
   → hormons → Thyroxin → ↓ ESV
   → adrenaline → ↓ ESV
   → glucagon → ↓ ESV

note

نفسها العوامل اللي تؤثر على Contractility ولكن بطريقة عكسية
أي أنه أي عامل يعمل زيادة ↓ ينقص ESV والعكس

* Factors effected the End diastolic Volume (EDV) (10)

1) Right atrial pressure (RAP) :-
   ↑V.R → ↑ RAP → ↑ EDV

↑main Circulatory pressur 7-10mmHg
↓
Blood ↑ Volume
↑V.C venous

2) Blood Volume :-
   - hypervolaemia → ↑MCP → ↑V.R → ↑RAP → ↑EDV

3) venous tone :- (during exercise)
   - veno Constriction → ↑ MCP → ↑V.R → ↑ RAP → ↑ EDV

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4) Intrapericardial pressure :-

↑intrapericardial pressure ⟶ ↓ decrease relaxation of ventricle ⟶ ↓ EDV

note :- any thing which ↓decrease relaxation of ventricle (it lead to ↓ EDV. ex:- tumor.

5) Atrial fibrillation (350-500 beat/min)

atrial fibrillation → weakness of atrial Contraction → ↓EDV

6) Intrathoracic pressure :-

↑ of its negativity (-3 to -6) ⟶ help venticular relaxation → V.R ⟶ ↑RAP ⟶ ↑ EDV

7) skeletal muscle Contraction :-

Contraction of muscle ⟶ squeezing in the vein → ↑V.R ⟶ ↑RAP ⟶ ↑EDV

8) Posture :- تأثير وضعي

- sudden standing ⟶ ↓V.R ⟶ ↓RAP → ↓EDV

لانقل بسبب الجاذبية

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9) ventricular stiffness and Compliance :-

- ventricular stiffness → ↓ relaxation of ventricular → ↓ EDV
- ventricular Compliance → ↑ relaxation of ventricular → ↑ EDV

10) atrial systole :-

↑ RAP → ↑ EDV

* Factors that affect the Cardiac output :-

1) stroke volume
2) Heart rate (60-100)

* effects of changes in the H.R on the C.O :-

1) if the heart rate = 50 (during rest) → the Cardiac output (Constant)

- ↓ H.R → ↑ EDV → ↑ length of m → ↑ Contractility → ↑ S.V

(بسبب زيادة فترة diastole)

(يعمل تعويض compensated) لنقص الـ H.R يحافظ على الـ C.O ثابت

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2) if the heart rate = 40 ⟹ ↓ Cardiac output
→ ↓H.R ⟶ ↑S.V

→ 3rd pace maker

3) if the heart rate = 200 (during exercise)
→ ↑C.O
↑H.R ⟶ ↑ Contractility of heart due to
a) stimulation of sympathetic.
b) ↑H.R → depolarization → ↑Ca+ influx to heart
c) Booster pumping action.
↑C.O ⟵ ↑S.V

4) if heart rate more than 200 → ↓ Cardiac output
in this state, they can't do any exercise.

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العلاقة طردية مع S.V ←

Second :- venous return (V.R) :-

it affected by :-

1) Main Circulatory Pressure (MCP)

↑ MCP ⟶ ↑ V.R

2) Right atrial pressure (RAP)

↑ RAP ⟶ ↓ V.R

كلما زاد فارق الضغط بين Vein & R.A يكون diffusion اسرع واسهل

3) Resistance to the V.R (RVR)

↑ RVR ⟶ ↓ V.R

Regulation of Cardiac output

Extrinsic regulation

عوامل خارجية

- Nervous (Autonomic)
  - Sympathetic
  - Para-
  - ⟶ it regulates the H.R & S.V
- Hormones & drugs

Intrinsic regulation

عوامل داخلية

- Heterometric autoregulation
- Homometric autoregulation

⟶ it regulates the S.V only

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First :- Extrinsic regulation :-

1 Nervous (Autonomic) :-

a) Sympathetic :- (↑ C.O)

→ ↑ C.O by ↑ S.V (contractility) & ↑ H.R
↳ ↑ the Coronary blood flow (V.D)

b) Parasympathetic :- (↓ C.O)

→ ↓ C.O by ↓ H.R
↳ ↓ the Coronary blood flow (V.D)

2 Hormones & drugs :-

a) glucagon hormone :-

↑ C.O by ↑ Contractility (S.V)

note لبنكرياس glucagon: يفرزمن ال ويشتغل عكس ال insulin

b) adrenaline hormone :-

↑ C.O by ↑ S.V & ↑ H.R

c) acetylcholine :-

↓ C.O by ↓ H.R # كيف !!!

d) Thyroxin :-

↑ C.O by ↑ H.R & ↑ S.V

e) Xanthines → قهوة

↑ C.O by ↑ S.V

f) digitalis :-

↑ C.O by ↑ S.V

g) hypoxia, hyperCapina, acidosis, MyoCardial ischemia :-

↓ C.O by ↓ H.R & ↓ S.V

صاحبي وظائف ال glucagon

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Second :- Intrinsic regulation :-

[1] Heterometric autoregulation :-

→ it regulate S.V through change of length of muscle fibers.

↑ length → ↑ S.V

[2] Hemometric autoregulation :-

→ it regulate the S.V without change in the length of muscle fibers.

*physiological variation of C.O :-

1) sleep :- C.O is Constant

↓ H.R → ↑ S.V → C.O (constant)

2) posture :- ↓ V.R بسبب الجاذبية

↓ C.O → ↓ B.P → ↑ H.R

3) meals :-

↑ C.O → ↑ blood supply (V.P) → ↑ V.R

4) Pregnancy :- C.O ثابت في الأشهر الأولى

↑ C.O → ↑ blood supply to utreus.

5) temperature :-

↑ H.R → ↑ C.O

6) Emotions

7) muscular exorcise → ↑ C.O → ↑ sympathetic → ↑ H.R & ↑ S.V (contractility)

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